Small Business Innovation Research/Small Business Tech Transfer

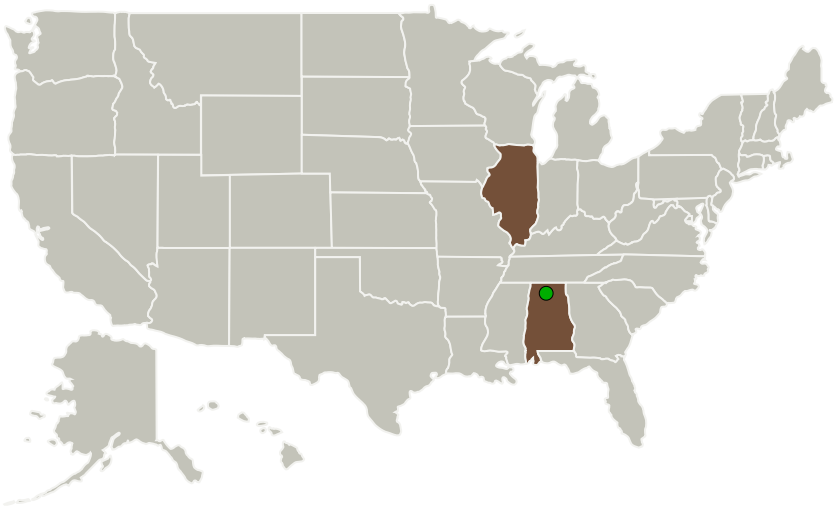
Real-Time Thermal Stir Weld Temperature Monitor, Phase I

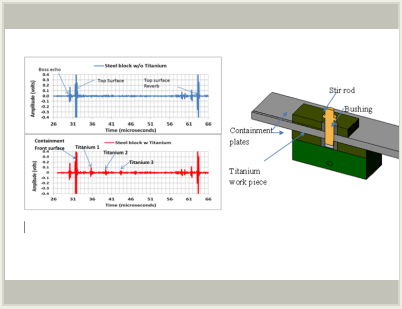
Completed Technology Project (2016 - 2016)

Project Introduction

Thermal stir welding (TSW) is a solid state welding process which has shown promise in joining high strength, high temperature metals needed for space launch systems. Although TSW offers an approach which allows more precise control of the temperature, better measurement of temperature in the weld zone is needed. The Industrial Measurement System Inc. (IMS Inc.) and University of Alabama in Huntsville (UAH) team propose to demonstrate the feasibility of ultrasonic thermometry technique to measure temperature, in real-time, in the fusion zone, during the TSW process. Using sensors attached to the containment plates, precise time-of-flight (ToF) measurements of ultrasound propagating through the fusion zone will be used to estimate temperature. This temperature measurement is non-intrusive and does not influence the thermal transport in the weld zone. Temperature data can be obtained at data rates as high as 1 kHz with the precision of a few degrees Centigrade. Thus, these measurements can be used as feedback controls in in-situ process control strategy for the TSW process. Precise temperature control will enable superior mechanical properties in the weld joint and thus maximize the capability of the TSW weld process.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Industrial Measurement Systems Inc.	Lead Organization	Industry	Aurora, Illinois
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Illinois

Project Transitions

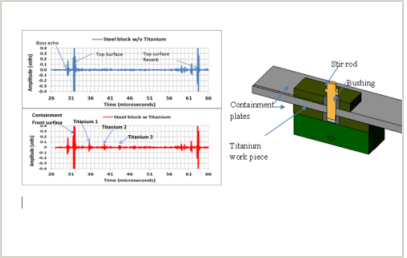
June 2016: Project Start

December 2016: Closed out

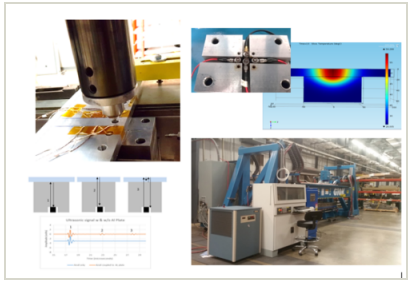
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139812)*

Images



Briefing Chart Image
Real-time Thermal Stir Weld Temperature Monitor, Phase I
(https://techport.nasa.gov/image/134612)



Final Summary Chart Image
Real-time Thermal Stir Weld Temperature Monitor, Phase I Project Image
(https://techport.nasa.gov/image/131559)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Industrial Measurement Systems Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

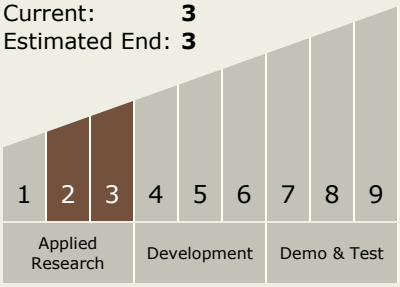
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Donald E Yuhas

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Completed Technology Project (2016 - 2016)

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.1 Manufacturing Processes

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System